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The Distribution of Bone Mineral Density in Healthy Women in Tehran*

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Aim: Correct interpretation of Bone Mineral Densitometry (BMD) measurements requires a population–specific reference range. The aim of this study was to establish Dual Energy X-ray Absorptiometry (DEXA) BMD reference values for healthy women residing in Tehran.

Materials and Methods: 566 healthy female volunteers aged 20-40 years from five district areas in Tehran participated in the study. BMD was determined by a LUNAR system. Measurement sites were the spine, femur, leg, arm, pelvis and total body. All measurements were performed by an experienced staff. Prior to each measurement, quality control testing was performed by using the spine phantom of known density. The subject was placed in a technically appropriate position for scanning of each region.

Results: Our results showed the spine BMD of Iranian women was about 9.28% higher and femur BMD about 11.9% lower than LUNAR reference values. Peak BMD values for arm, leg, pelvis and total body were 0.7-7% lower than LUNAR reference values. Our values were also different from those of Arab, Caucasian, European, and Turkish women.

Conclusions: Diagnosis of osteoporosis and interpretation of BMD in Iranian women should be based on our population-specific reference range. Further studies will clarify the statistical value to use as a BMD reference.

Key Words: DEXA, BMD, osteoporosis, Iranian women

Tahran da Sağlıklı Kadınlarda Kemik Mineral Yoğunluğu

Amaç: Kemik mineral yoğunluğu ölçümlerinin doğru yorumlanabilmesi nüfusa özel referans değerlerinin kullanımını gerekli kılar. Bu çalışmada, dual enerjili X ışınlarına dayalı absorbtimetre kullanılarak Tahran'da yaşayan sağlıklı kadınların kemik mineral yoğunluğu referans aralıklarının saptanması amaçlanmıştır.

Yöntem ve Gereç: Tahran'ın belirli bölgelerinde yaşayan yaşları 20-40 arasında değişen 566 sağlıklı kadın gönüllü bu çalışmaya katılfı. Kemik mineral yoğunluğu LUNAR sistem kullanılarak belirlendi. Ölçümler omurgalar, femur, bacak, kol, pelvis ve tüm vücut bölgelerinde yapıldı. Bütün ölçümler deneyimli elemanlarca yapıldı. Her ölçüm öncesi, kalite kontrol testleri yapıldı. Her bölgenin görüntülenmesi öncesi bireyler uygun pozisyonda yatırıldı.

Bulgular: İranlı kadınların omurga kemik mineral dansitesi LUNAR referans değerlerinden yaklaşık olarak % 9.3, femur mineral dansitesi ise % 11.9 daha yüksekti. Kol, bacak, pelvis ve tüm vücut için ölçülen pik değerler LUNAr referans aralığından % 0.7-7 arasında daha düşüktü. Bu değerler Arab, Kafkas, Avrupalı ve Türk kadınlarının değerlerinden de farklı idi.

Sonuç: İranlı kadınlarda osteoporoz tanısı ve kemik mineral dansite ölçümlerinin yorumlanması bizim bulgularımıza dayandırılmalıdır. da kemik mineral dansitesi refrans aralığının istatistik değerlerini saptamak için de yeni çalışmalar yapılacaktır.

Anahtar Sözcükler: Osteoporoz, sağlıklı kadın, kemik mineral dansitesi, İran

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Introduction

Bone Mineral Densitometry (BMD) measurement is widely used for diagnosis of osteoporosis and determination of its severity (1-7). It has been well recognized that there are racial/ethnic differences in BMD values. There is increasing evidence that correct interpretation of BMD measurements requires a population–specific reference range (4-8). BMD values in blacks are about 8-12% higher than in Caucasians [9,10]. Asian women have lower BMD than Caucasians (11,12). Study of Saudi females has shown that BMD values are about 5% lower than those of US and North European women (13,14). Reference values have also shown BMD differences between Arab counterparts (13-16). This is in contrast to virtually identical values in different white populations (9,17-19). One exception is France, where the BMD in French women is less than that in North European women (20). Due to lack of appropriate population-specific reference values in Iran, our interpretation of BMD and diagnosis of osteoporosis is based on the data from Japanese and/or Asian immigrant populations residing in the United States.

The aim of this study was assessment of Dual Energy X-ray Absorptiometry (DEXA) BMD reference values of healthy women residing in Tehran.

Materials and Methods

A prospective study was conducted in 2005 on 566 healthy female volunteers aged 20-40 years. Tehran has a population of 11,000,000 including 50 restricted areas. Five district areas which included a female population of 566,000 were randomly chosen in the north, south, west, east and central parts of Tehran. The participants were randomly selected in these areas in Tehran based on 1 per 1000 female population. Each regional group of volunteers consisted of about 113 subjects. After explaining the purposes of the study, an informed consent was obtained from the volunteers. The protocol was approved by the ethical committee of Shaheed Beheshti University. All of the Iranian women evaluated were healthy with regular physical activity. The selected women had a regular dietary regimen including 1000-1200 mg calcium per day. Due to the usual sunny weather of Tehran, residents have sufficient vitamin D synthesis. Individuals taking medication affecting calcium metabolism or with a medical condition known to affect bone metabolism (e.g. amenorrhea, anorexia neurosis, premature ovarian failure) were excluded. Smokers and subjects with family history of osteoporotic fracture were also excluded. Pregnancy and any contrast enhanced radiography taken in the previous 10 days served as exclusion criteria. BMD was determined by a LUNAR device with DEXA system.

Measurement sites were the spine, femur, leg, arm, pelvis and total body. All measurements were taken by an experienced staff to reduce inter-operator variability. Prior to each measurement, quality control test was performed using the spine phantom of known density. For scanning of each region, the subject was placed in a technically appropriate position. Data were saved in an SPSS 10 software package. T-test was used for statistical analysis and $P<0.05$ was declared as significant.

Results

The BMD results are presented in two 10-year age groups (20-29 and 30-39). The means and standard deviations of BMD for each part of the body and total BMD are shown in Table 1. The mean peak BMD measurements (g/cm^2) at different parts and total body for Iranian women (age 20-39) and LUNAR reference database values are presented in Table 2. A comparison of the mean BMDs at spine and femur for Iranian versus other populations by decade of age is presented in Table 3.

Table 1. The mean and standard deviations of BMD (in g/cm^2) at different parts and total body for Iranian women residing in Tehran.

	Age 20-29 N=322	Age 30-39 N=244	Age 20-40 peak BMD N=566
Total Body	1.125 ± 0.11	1.13 ± 0.07	1.13
Femur	0.97 ± 0.17	0.97 ± 0.12	0.97
Arm	0.83 ± 0.08	0.86 ± 0.06	0.84
Leg	1.15 ± 0.12	1.16 ± 0.09	1.155
Pelvis	1.09 ± 0.14	1.095 ± 0.1	1.092
Spine (L2-L4)	1.25 ± 0.18	1.25 ± 0.14	1.248

Table 2. A comparison of the mean peak BMD values (in g/cm^2) at different parts and total body for Iranian females (age 20-39) and LUNAR reference database values.

	Mean in samples (g/cm^2 n=566)	Reference	Increase (+) Reduction (-) (percentage)
Total Body	1.13	1.21	-7.3
Femur	0.97	1.019	-11.9
Arm	0.84	0.848	-0.7
Leg	1.155	1.153	+0.17
Pelvis	1.092	1.112	-1.79
Spine	1.248	1.142	+9.28

Table 3. A comparison of the mean BMD measurements (in g/cm^2) at spine and femur sites for Iranian and other populations by decade of age.

	Age	North Europe	Kuwaiti	USA	Caucasian	Saudi	Lebanese	Iranian
Spine	20-29	1.19	1.21	1.24	1.19	1.14	1.10	1.25
	30-39	1.20	1.23	1.22	1.21	1.18	1.11	1.25
Femur	20-29	1.02	1.02	1.00	1.018	0.98	0.91	0.97
	30-39	0.99	1.015	1.00	0.99	0.937	0.98	0.97

Discussion

In this study, we investigated the normal BMD values in Iranian young adult women. The results indicate that the BMD of Iranian women differ from LUNAR reference data from Japanese or Asian immigrants residing in the United States. For the spine and leg, the Iranian values were 9.28% and 0.17% higher than the LUNAR Japanese-Asian reference data, respectively (Table 2). Our BMD measurements for healthy Iranian women demonstrate that differences exist between our results and counterparts from other countries. The Iranian values for the spine were higher than the Arab reference values (13-16). There is a similar pattern in comparison with Caucasian and North European females (12,17-19). In contrast, femoral BMD in Iranian women was lower in comparison with north European, American, Caucasian, and Kuwaiti females (9,12,15,17-19). However, femoral BMD in Iranian women was slightly higher than the values for Lebanese women.

A study of healthy Turkish females aged 20-39 years found peak BMD values of the lumbar spine and femur of 0.98 and 0.89 g/cm^2, respectively, which are 10-30% lower than our results for femur and spine (21).

Our appropriate sample size is a reliable normative Iranian database for comparison with other population BMD studies (15,22). Meanwhile, caution should be used in interpretation of BMD results and diagnosis of osteoporosis for Iranian patients in comparison with other reference databases. The spine BMD was higher and femur BMD lower in Iranian women than other reference ranges, supporting the importance of a national reference data range for BMD measurement.

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